
Screening of soybean cultivars against *Phakopsora pachyrhizi* causing soybean rust disease at two altitudes of Meghalaya

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A total of 58 soybean cultivars were screened by growing them at two altitudes of Meghalaya, India, for their resistant or susceptible reactions to soybean rust caused by *Phakopsora pachyrhizi*. At lower altitude none of the cultivars tested showed resistant reaction. At higher altitude cultivars NRC-25 and Punjab-1, however, showed resistant reaction to rust infection. Majority of the cultivars, screened during the present study, were either moderately susceptible or susceptible. At higher altitude 51.7% of the cultivars showed moderately susceptible reactions to soybean rust as compared to 50% at the lower altitude.

Key words : Soybean rust, susceptible, resistant, cultivars

INTRODUCTION

Soybean rust, caused by *Phakopsora pachyrhizi*, is a serious disease of soybean in this part of the country. It is recognized as one of the major constraints in increasing soybean production in the northeastern part of India. It is an endemic disease of N. E. Hill states of India. It is also identified as the most dreaded disease in Asia and Australia and is potential threat to other soybean production regions as well (Anonymous, 1974 ; Bromfield, 1974).

This disease has been first reported from India in September 1970. All commercial soybean varieties grown at that time have been found to be susceptible to this disease (Thapliyal and Choudhury, 1976). *P. pachyrhizi* infection in north east region results in yield loss to an extent of 36% (Kumar and Verma, 1985).

With increasing concern about environment pollutions and related health hazards due to agricultural activities the world over, the screening of resistant varieties or highly tolerant varieties is important in crops like soybean to reduce the incidence of residual effect. Identification of resistant varieties

would also help the farmers in the management of this disease. The present study, therefore, has been undertaken to screen commonly grown soybean cultivars at lower and higher altitudes of Meghalaya, India.

MATERIALS AND METHODS

The study was conducted in Shillong, Meghalaya at two altitudes i.e. lower altitude (at Barapani, 900 m MSL) and higher altitude (at Upper Shillong, 1500 m MSL). Fifty-eight cultivars of soybean were selected for this study. They were sown at the experimental sites during the *kharif* season. The study was conducted in 1994 and was again repeated in 1995. The cultivars were sown in a randomized complete block design with two replications. Each cultivar was sown in a plot of 2 rows measuring 1 meter in length/row. The two rows were 40 cm apart and the distance between two plants in a row was 10 cm. Soybean cultivar Ankur was sown after every 5-test row as a susceptible check. Recommended agronomic practices were followed. The trials were conducted under rainfed conditions.

The cultivars were screened for rust resistance on

the basis of the development of the disease, which was evaluated using 0-9 scales. IWGSR's (International working group on soybean rust) three digit evaluation system was used for the final classification of disease reactions of different hosts to the pathogen (Yang, 1977). Harvesting experimental test rows and drying seeds to 16% moisture level estimated yield. It was recorded in g/row for each cultivar.

RESULTS AND DISCUSSION

The reaction of 58 cultivars of soybean to rust disease at lower altitude is presented in Table 1. None of the cultivars tested at lower altitude showed resistant reaction to the disease during both the years of study. Out of the 58 tested only two i.e. NRC-25 and JS 80-21, were moderately resistant where as the rest were categorized either as moderately susceptible or susceptible. The score ranged from 3 to 7 in different cultivars during both the years of investigation. At higher altitude soybean cultivars NRC-25 and Punjab-1, however, showed resistant reaction to the disease (Table 2). At higher altitude 36.2% of the total cultivars were rated as moderately resistant, while 51.7% as moderately susceptible and 8.61% as susceptible compared to 3.45%, 50% and 46.55% respectively at lower altitude. The results of this study clearly indicated that different cultivars behaved differently as regards to their reaction to the rust disease at the two experimental sites situated at two altitudes. At higher altitude the disease appeared 15 days after it appeared at the lower altitude. The delayed appearance of the disease at higher altitude could be due to the prevalence of low temperature during the cropping period. Kochma (1979) concluded that optimum temperature is an important factor for rust development in soybean. Shanmugasundaram (1980) also reported variation in rust development in soybean at two different locations in Taiwan. He related this to availability of large quantity of inoculums and favourable environmental conditions for disease development at one location than the other. The low frequencies of rust resistant lines (Table 3) obtained in the present study are in conformity with the findings of Maiti *et al* (1983) and Chandra *et al* (1987). On the basis of the results of this study it is recommended that cultivars NRC-25, Punjab-1, PK-1134, Bragg, MACS-431, DS-93-79A, JS (SH) 89-58, JS

Table 1 : Reaction of Soybean cultivars to soybean rust at Barapani in 1994 and 1995.

Cultivars	IWGSR rating		Disease score (0-9)		Yield gm/row	
	1994	1995	1994	1995	1994	1995
MAUS-38	333	333	4	4	152.5	60.6
PK-1135	343	343	5	6	187.5	30.0
UGM-52	343	333	6	4	255.0	67.5
MAUS-45	333	343	4	6	117.5	32.5
JS (SH) 89-48	333	343	5	7	190.0	42.5
PK-1135	343	343	6	6	80.0	50.0
NRC-19	333	343	5	5	2050.0	37.5
NRC-18	333	343	3	6	175.0	30.0
PK-1125	333	323	4	3	157.5	35.0
MAUS-53-2	343	333	5	5	152.5	42.5
VLS-45	333	332	4	3	197.5	87.5
JS (SH) 98-2	333	333	4	4	177.5	37.5
KB 117	343	333	6	5	299.0	62.5
HIMSO 1563	343	333	6	5	81.0	35.0
PK 1134	343	323	6	3	367.5	107.5
TAS 9203	333	332	4	3	200.0	155.0
VLS 43	343	333	6	5	307.5	52.5
HIMSO 1565	323	332	4	3	135.5	175.0
NRC 23	323	333	4	5	205.0	77.5
MAUS 49-1	333	343	4	6	190.0	55.0
TAS 41	333	333	5	5	247.5	50.0
NRC-22	333	333	5	5	247.5	72.5
JS(SH) 89-49	333	333	5	4	250.0	140.0
Bragg	333	333	5	5	190.0	80.0
MACS 428	333	333	4	5	185.0	122.5
NRC 24	333	333	5	5	155.0	42.5
PK 1133	343	333	6	5	210.0	45.0
MACS 458	333	333	4	4	155.0	62.0
MACS 43	333	333	3	5	200.0	45.0
DS 93-79-A	333	343	4	6	135.0	30.0
JS(SH98-58)	333	333	5	4	247.5	102.4
NRC-26	333	343	5	4	202.5	47.5
DS 93-108-13	333	332	5	3	67.5	35.0
NRS 25	323	323	3	3	205.0	192.5
PK 1112	333	333	5	5	210.0	75.0
MACS 441	333	333	4	5	90.0	40.0
DS 93-104-3	333	333	4	4	217.5	80.0
MAS 414	333	333	3	4	150.0	42.5
Birsa Soyat	333	343	5	6	187.5	37.5
Punjab-1	343	343	6	6	230.0	52.5
JS 80-21	323	332	3	3	345.0	152.5
MACS 58	343	333	7	4	252.5	112.5
MACS 24	343	33	5	5	252.5	62.0
NRC 2	333	343	5	5	150.0	30.0
PK 262	343	333	7	5	150.0	42.5
Pusa 20	323	333	3	5	187.5	37.5
JS 75-46	343	333	6	5	242.5	70.0
PK 471	343	333	6	5	357.5	35.0
PK 564	323	343	3	6	190.0	60.0
PK 416	333	333	4	4	272.5	90.0
Moneta	343	343	6	6	312.5	47.5
Durga	343	333	6	5	180.0	60.0
NRC 1	333	333	4	5	152.5	55.0
MACS 13	333	343	5	6	210.0	30.0
PK 472	333	333	5	5	182.5	47.5
JS-335	323	333	3	4	120.0	85.0
Pusa-16	333	343	4	7	265.0	67.5
PK 327	333	343	5	7	172.2	50.0
C.D. (P = 0.05)	—	—	2.2	1.9	132.6	44.1

Reaction grade	IWGSR rating.
Immune	311.
Resistance	122, 123, 132, 133, 222, 223.
Moderately resistance	142, 143, 232, 233, 242, 322, 323.
Moderately susceptible	332, 333.
Susceptible	343.

Table 2 : Reaction of Soybean cultivars to soybean rust at Upper Shillong in 1994 and 1995.

Cultivars	IWGSR rating		Disease score (0-9)		Yeild gm/row
	1994	1995	1994	1995	
MAUS 38	311	333	2	6	50.0
PK-1135	311	333	1	6	35.0
UGM 52	311	333	1	6	50.0
MAUS 45	311	343	1	7	50.0
JS(SH 89-48)	311	343	1	6	40.0
PK 1137	311	343	1	7	32.4
NRC 19	133	343	2	7	50.0
NRC 18	311	343	1	7	45.5
PK 1125	311	333	1	6	50.0
MAUS 53-2	311	333	1	6	50.0
VLS 45	143	333	3	6	40.0
JS(SH)98-2	311	333	1	6	50.0
KB 117	311	333	1	6	50.0
HIMSO 1563	311	333	1	6	35.0
PK 1134	311	323	1	6	45.5
TAS 9203	311	333	1	6	50.0
VLS 43	311	333	1	6	35.0
HIMSO 1565	311	333	1	6	50.0
NRC 23	311	333	1	6	50.0
MAUS 49-1	311	333	1	6	50.0
TAS 41	311	333	1	6	42.5
NRC-22	311	333	1	6	55.0
JS(SH) 89-49	311	333	1	5	50.0
Bragg	311	323	1	5	50.0
MACS 428	311	333	1	6	50.0
NRC 24	311	333	1	6	50.0
PK 1133	311	333	1	6	35.0
MACS 458	311	323	1	6	25.0
MACS 43	311	323	1	5	30.0
DS 93-79-A	311	323	1	5	32.5
JS(SH98-58)	311	323	1	5	45.0
NRC-26	311	333	1	6	50.0
DS 93-108-3	311	233	1	5	25.0
NRS 25	311	223	1	3	50.0
PK 1112	333	333	5	6	50.0
MACS 441	333	323	5	5	50.0
DS 93-104-3	123	333	3	4	52.5
MAS 414	311	323	1	4	40.0
Birsa Soyat	133	333	2	4	50.0
JS 80-21	311	322	1	4	45.0
MACS 58	311	323	1	5	35.0
MACS 24	311	323	1	4	40.0
NRC 2	123	323	2	4	50.0
Punjab 1	311	223	1	3	2.5
PK 262	322	323	1	5	40.0
Pusa 20	311	323	1	5	50.0
JS 75-46	311	323	1	4	45.0
PK 471	311	323	1	5	22.5
PK 564	311	33	1	5	30.0
PK 416	123	333	2	4	35.0
Moneta	311	323	1	4	40.0
Durga	123	323	2	4	30.0
NRC 1	311	333	1	5	20.0
MACS 13	123	323	2	5	40.0
PK 472	123	333	2	5	50.0
JS-335	123	323	2	5	50.0
Pusa-16	311	323	1	5	50.0
PK 327	311	323	1	4	50.0
C.D. (P = 0.05)	—	—	1.6	1.0	4.7
Reaction grade	IWGSR Rating				
Immune	311				
Resistance	122, 123, 132, 133, 222, 223				
Moderately resistance	142, 143, 232, 233, 242, 322, 323				
Moderately susceptible	332, 333				
Susceptibe	343				

Table 3 : Reactions of Soybean cultivars to soybean rust

Reaction	Cultivars	
	Upper Shillong	Barapani
Resistant	NRC-25, Punjab-1	NIL
Moderately resistant	PK1134, Bragg; MACS-431; DS-93-79A; JS(SH) 89-58; DS 93-108-B; MACS-414; JS80-21; MACS-58; MACS-24; NRC-2; PK262; Pusa-20; JS 75-46; PK-471; Moneta; Durga; MACS-13; JS-335; Pusa-16; PK 327.	JS80-21 ; NRC-25
Moderately Susceptible	MACS-38; Pk1135; UGM-52; PK 1125; MAUS 53-2; VLS-45; JS(SH)89-2; KB 117; HIMSO-1563; NRC-23; MACS-58; MACS-49-1; JS(SH)89049; TAS-41; NRC-22; MACS-428; NRC-24; PK-1133; MACS-441; DS93-104-3; Birsa soyat; PK 564; PK 416; NRC-1; PK 472.	MACS-38; NRC-19; PK 1125; VLS-45; JS(SH)89-2; TAS-9203; HIMSO-1565; NRC-23; JS(SH)89-49; TAS-41; NRC-22; Bragg; MACS-428; NRC-24; MACS-458; MACS-431; JS(SH)89-58; PK-1112; MACS-414; DS93-104-3; Punjab-1; Pusa-20; PK 416; NRC-1; PK 472; JS-335; Pusa-16.
Susceptible	MACS-45; JS(SH)89-98; PK 1137; NRC-19; NRC-18.	PK 1135; UGM-52; MACS-45; JS(SH)89-48; PK 1137; NRC-18; MAUS-53-2; Kb-117;; HIMSO-1563; PK-1134; VLS-43; MAUS-43; PK-1133; DS-93-79-A; NRC-26; Birsa soyat; MACS-58; MACS-24; NRC-2; PK-262; JS 75-46; PK-471; PK-564; Moneta; Durga; MACS-13; PK-327.

80-21 and cultivars NRC-25 and Js 80-21 respectively should be used at higher and lower altitudes of Megalaya for the management of soybean rust.

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